bling a curve or other shape could be achieved by a precise series of ball bearing **1-11** activations.

EMBODIMENT 2

[0038] A second embodiment of the present invention is shown in a cross-sectional view by FIG. **2**. A rod **2-10** can be made to move up and down depending the activation of one or more driving coils **2-20** or the like to become magnetic. The driving coils **2-20**, when magnetized act on the rod **2-10** or a magnet **2-11** (or a set of magnets) in the rod **2-10**. It is to be understood that while described as driving coils, many types of magnetic materials and shapes may be used.

[0039] When higher driving coils are activated, the rod **2-10** moves up to an extended position with respect to the surface **2-50** of the image display. A space **2-31** may be provided underneath the rod **2-10** to allow for a retracted position of the rod **2-10**.

[0040] Rod **2-10** may be placed between pixels (not shown) of the image display. According to an aspect of the present embodiment, such rods would be required between each pixel of the image display to provide a fine tactile resolution, however this may not be necessary for all implementations of the present invention.

EMBODIMENT 3

[0041] A third embodiment of the present invention is shown by FIGS. **3**A-**3**E. A view of the image display **3-1** with air holes is shown by FIG. **3**A. Small holes in the image display are situated between the pixels (not shown). The holes are formed at a slight angle or tilt, such that air that is blown out of one or more of such tilted air holes **3-12**, **3-13**, causes the object **3-2** at, near or on the surface to be blown in a specified direction of movement **3-32**. The image display is viewed in FIG. **3**A from above, if the image display **3-1** is arranged horizontally, or from the front, if the image display is arranged vertically.

[0042] Air may be blown in four directions based on the tilt orientation of air hole **3-11** that is active in blowing air. At any one time only a few of the holes may be opened, as controlled by a motion signal, in order to control the motion of one or more objects at the surface of the image display **3-1**.

[0043] A front plate **3-71** of the image display is equipped with holes that are formed at an angle (facing north, south, east and west). For example, hole **3-11** of FIG. **3**D is tilted toward the west, from the point of view of the page that contains the figure. West hole **3-12** of FIG. **3**B also is tilted west and shows a direction of air blown out through such a hole, while east hole **3-13** is tilted east and shows a direction of air blown out through such a hole.

[0044] A motion of an object **3-2** of FIG. **3**E would be determined by the tilt orientation of the holes that are active in blowing air. More than one hole **3-11** may be activated at any one time and several holes in any one area of the image display could be used to move the object **3-2**. Also, activation of holes of different tilt orientations in the area of the object **3-2** could be made use of to cause object **3-2** movement that is not due east, due south, due west or due north. For example, activation of one or more holes with north tilt orientation in the area south of the object **3-2** simultaneously with activation of one or more holes with west tilt orientation in the area east of the object **3-2** could be used to cause object **3-2** motions in a north-west direction. Similarly, an object **3-2** trajectory resembling a curve or other shape could be achieved by a precise series of hole **3-11** activations.

[0045] According to an aspect of the present embodiment, holes may be arranged in sets of four, such that each hole of the set of four holes is located at a corner of an imaginary rectangle figure. Accordingly, each hole of the set of four holes could be tilted in a different direction than the remaining holes of the set.

[0046] Further, it will be appreciated that longer motions of object **3-2** could be achieved by serial activation of holes. For example, a time-delayed activation of adjacent similarly tilted air holes would cause the object **3-2** to experience continuous air pressure from behind, causing a longer movement. Also, the amount of air pressure applied through air hole **3-11** could also be controlled, based on the type of application (for example type of object to be moved: in chess for example, there are smaller and larger pieces), and the desired speed of the motion. Fine control over the timing of the activation sequence of the air holes could then effect acceleration, deceleration and speed control of the object.

[0047] According to an aspect of the invention, control of the airflow through the air holes may be achieved by using a control layer **3-59** including row-electrodes **3-51** arranged on the front plate **3-71** and column-electrodes **3-52** arranged on the back-plate **3-72**. It will be appreciated that this arrangement could be reversed. A foil **3-53** is disposed between the front plate **3-71** and the back plate **3-52**. While described as a foil, it will be appreciated that many types of conductive media could be used instead of a foil, or in combination with a foil. The foil **3-53** may be a conductive sheet, or a sheet electrode could be arranged on or in the entire foil.

[0048] When the voltage-difference between row-electrode **3-51** and the foil **3-53** is sufficiently high, the foil will be pulled towards the front-plate along the row-electrode and thereby close the air hole **3-11**. When the voltage-difference between the column electrode **3-52** and the foil **3-53** is sufficiently high, the foil will be pulled toward the back plate along the column electrode and thereby open the hole. Thus, the holes can be selectively opened and closed with passive matrix addressing.

[0049] According to an aspect of the present embodiment, as shown by FIG. **3**C, an inlet channel **3-5** or several inlet channels or holes may be formed between the air holes to create a pressure in a space **3-60** between the front plate and the back plate that is higher than the air pressure at or near the surface. By selectively opening air holes the airflow can be used to move the object **3-2**. It will be understood that according to an aspect of the present embodiment, control over the motion of object **3-2** along the surface is consistent with the hovercraft-principle.

EMBODIMENT 4

[0050] A fourth embodiment of the present invention is shown by FIGS. **4**A-**4**C. In the fourth embodiment, a pixel-actuator matrix **4-19** includes actuators **4-10** made up of a set of rods, rods **4-111** and **4-112** or tubes that consist of material that can grow and shrink depending on the voltage applied to them. As shown by FIG. **4**B, the left rod **4-111** and the right rod **4-112**, are two rods attached together, such that the right rod **4-112** is slightly larger because of a small current placed on it.

[0051] According to an aspect of the present embodiment, a dielectric film may be used to provide a degree of electric insulation between the left rod **4-111** and the right rod **4-112**,